

A Comparative Study on Mobile Platforms (Android vs. IOS)

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Abstract—The innovation of mobile devices and applications for mobile devices has created a huge economic value. Powering the mobile devices with the internet and making the information, entertainment etc. accessible wherever the user is, have raised the adoption rate to a new heights.

In this paper we perform a comparative study on the overall impact on the consumers of the two major mobile platforms I.e. Android and IOS.

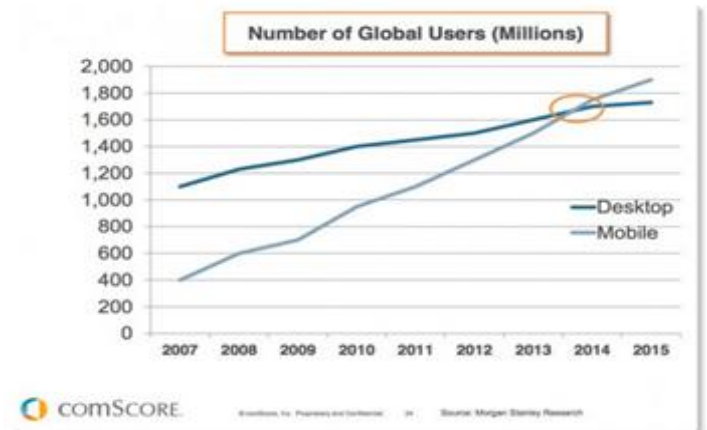
We conclude by accounting the advantages and drawbacks of each mobile platform and present some points for betterment in utilization of the Information Technology and also the arduous efforts to make the proper usage of the technology.

Index Terms—Mobile, Android, IOS, Technology, advertisement, application.

I. INTRODUCTION

The adoption rate of information technology from the early desktops computers to laptops to the smart mobile tech is increasing at each phase of technological advancement. The mobile technology is showing a huge adoption rate of two billion users across the world as per 2015 stats. Internet has changed the way the world works, by shrinking the barriers and making the world more open and also helped in encouraging the digital innovation.

The innovation of mobile devices and applications for mobile devices has created a huge economic value. The supply of diverse mobile apps from the online App Stores have created a huge market value for many businesses and individual app developers across the world. The below is the figure which shows the adoption rate of mobile technology over the earlier Desktop technology from 2007-2015.



Source: <http://www.smartinsights.com/>

In this paper, we account the frictions in the development of two most liked mobile platforms (I.e. Android and IOS) and the scenarios that exacerbate the marketing, commercialization strategies and also the procedures employed to handle the enormous traffic online.

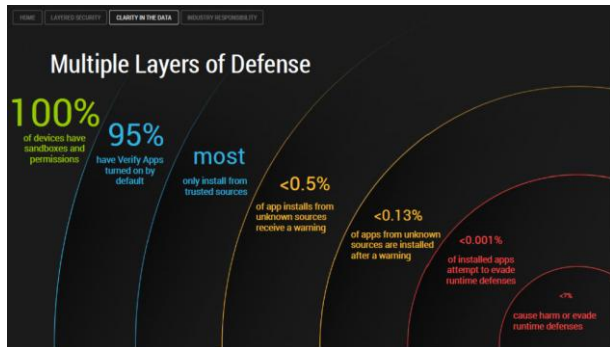
II. INTRODUCTION TO SELECTED PLATFORMS FOR COMPARISON

Google Inc. and Apple Inc. being the major players in building the mobile ecosystem with their widespread mobile operating systems, android and IOS platforms which are built with the recombination of General Purpose Components, have attracted many consumers and a diverse set of app developers across the world.

Android is the today's successful and widespread open source mobile OS built on Linux kernel which is powered by Google's services such as Search, Gmail, YouTube, Translate, Maps, etc. android being the open source platform, provides flexibility to customize the device according to the user's preferences and also alter the OS permissions as per the user's interest. With the powerful backend cloud support, Android runs diverse set of applications including 3rd party, middleware applications, multimedia, and helps its users to be more productive.

The unique security model of the OS puts the users in control of the devices. Google's control over the OS security makes the developers to walk through their model to design and develop an android app in JAVA. The OS has an ability to isolate the processes running on the OS with a unique UID, unlike Linux in which all the processes related to a particular

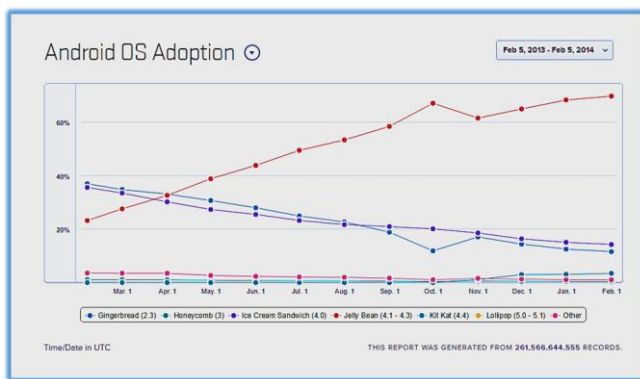
User has the same UID and has distinct permissions. Android maintains distinctive UIDs and permissions to a particular Android Application to isolate the processes with malicious intent and its activities. The application sandboxing feature in the OS prevents the exchange of data, but it can be exchanged explicitly. The multi layered defense model of android protects the OS and the information from malicious software by evading them from the system.



Source: <https://www.google.co.in/images>

A beautifully tailored, device hardware capabilities with graphics to create various touch and swipe gestures to interact with the objects on the screen and accommodate the information in the device screen and making it easily understandable by using the symbols, images in designing a User Interface, have set a new benchmark in designing a UI, which gives the user a seamless user interaction experience. In spite of the existence of diverse set of UI designs of android, which are designed by the carriers of OHA, google does not allow the apps which flout the UI design guidelines, not to sacrifice the user experience on android.

Since the inception of the android OS, there have been many incremental changes to the Operating System done by google which helped increase in the capabilities, productivity, security etc. at each phase, which fuelled the adoption rate of Android devices in the market and attracted huge set of consumers and entrepreneurs, today android has become a major player in the mobile sector. The below is the adoption rate of different versions of android from Feb, 2013 to Aug, 2015.



Source: <https://mixpanel.com/>

On the other hand IOS is another widely spread mobile OS developed by Apple Inc. it is Apple's proprietary and sold only with apple's hardware, since its inception in 2007. The devices are powered by the apple services and many

productive tools, apart from the apps downloaded from app store.

The entirely new architecture that is built in to the Operating System promises best possible security and lets the user to control app's accessibility to the resources in the system. With the tight application sandboxing for all the apps on IOS and also the advanced encryption and decryption techniques. At the core of the system, IOS contains a key called UID-key which is stored inside the CPU. Other keys used in the system are derived from that key. The architecture of the OS is designed to be tamper resistant.

III. COMPARISON CRITERIA FOR MOBILE PLATFORMS

There could be many ways to compare these platform

We select 6 criteria which are most significant: - User interface, Security/privacy, Availability of applications, extensibility and cost, advertisement.

A. User Interface (Android vs. IOS) "IOS UI info"

The Android UI

Android being an open source OS, it has diverse set of UI available and different capabilities which are carrier specific and are ported into the OS by various carriers, leaving behind the true flavor of android UI. The below mentioned are few android UIs which dissolve the Android's native UI.

Carriers	User Interface
Samsung	Touch Wiz UI
HTC	Sense UI
Sony Xperia	Xperia Home UI
LG	Optimus UI
Xiaomi	MIUI

Apart from the carriers in OHA, there are many independent developer teams working on customizing the Android OS (ex: AOKP, cyanogen mod, ProBam etc.). The usability and capabilities of these carrier specific android devices also differ among the carriers and also the independent developer teams.

Inconsistencies in Android UI

Since the inception of android, there were many versions of the OS that came into the market, each and every improved version has a new set of capabilities to perform tasks. But the common complication of the occasional lag while navigating among the objects on the screen, while reading the text or performing any other tasks on the device, which frizzles the user has remained till date.

In spite of android using diverse set of Graphics Processor Units (GPU) in many of its flagship devices, the inconsistencies in the device UI can be observed in many aspects (ex : playing games which involves more graphics,

pinch zooming etc.).

The IOS UI

Apple devices are known for their seamless UI which is supported by COCOA TOUCH API at the back and the premium feel that the apple device user gets, while doing simple gestures or navigation among the apps menu on the device. There were many incremental updates on IOS also to support the users and developers in their productivity along with improved security updates and also minor UI changes to make the usability of the product a bit easier. This made the IOS stand on top of mobile sector over time and increased the adoption rate of the apple devices. The below are the stats of various IOS versions and their adoption rates from 30th Aug, 2014 to 30th Aug, 2015.



Source: <https://mixpanel.com/trends>

B. Setbacks in Security (Android vs. IOS)

Applications in android can also create their own permissions if they intend to have a programmatic access to other application or among different applications. This can lead to a possible misuse of data by the other applications and might not come in to notice of the user, in spite of user allowing to share the data as the alert message shown to user while requesting to share the data seems promising. Applications should clearly delineate between the SQL statement and the data that is being carried in and out of SQLite database. The data in SQLite database of an app should be made accessible only to that particular app and the database files should be hid from the file explorer as the tampering of the database files in spite of the files being encrypted is possible.

In spite of android OS being built on Linux and sticks to the terms of system being an open platform. A privileged access (“root access”) to the android system should be tightened, as the device turns out to be completely vulnerable when it is rooted, leading to the possibility all attacks being successful on the system. Rooting of devices might help developers to be more productive, but it seems like over 60% of android devices across the world are being rooted. Be it a technical or non-technical person, devices are being mostly rooted to remove the annoying pre-installed apps of the device or to try some new features that are not available in that particular version of android.

Unlike android, IOS also walks the IOS app developers

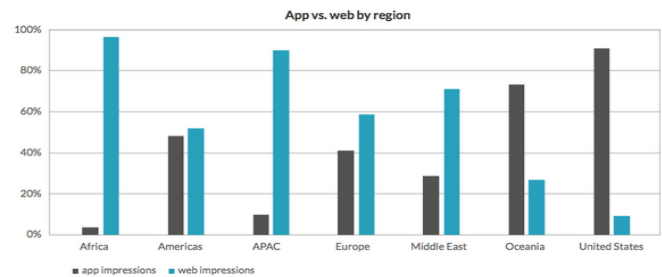
through its predefined guidelines to make the app run on the IOS device and it is also powered by a powerful apple cloud at the back to aid the app developers and users to be more productive.

As the Operating System is designed to handle plenty of operations under the hood. The device gets overheated when the CPU executes multitudinous instructions.

Apple maintains possible deniability for supporting the jail broken (root access) devices. And side loading of apps is only possible in jail broken devices. Though a tiny percent of IOS users bother to jailbreak their device.

C. Extensibility (Android vs. IOS)

There are various IDEs and mediator suits, frameworks and APIs that are available in the market which help developers to build mobile apps (ex: PhoneGap, Cordova, Sencha etc.) using the programming languages like HTML5, JavaScript, CSS, JQuery etc. to build web or hybrid mobile applications for both the platforms. According to the recent survey, the usability of mobile web and mobile apps has a diverse usability levels at different regions across the world. The below are the stats of the usage of mobile web and mobile apps on the basis of mobile advertising impressions.



Source: <http://venturebeat.com/2015/07/28/think-the-web-vs-mobile-app-battle-is-over-only-in-the-usa/>

So, the small scale to large scale businesses either use a mobile app or mobile web or both, based on their targeted regions and dependability on either of them. Apart from the dependability of users in various countries, availability of resources is also a criteria where the developers choose between the mobile app and mobile web. In order to be cost-effective, developers choose to develop a native app or a hybrid app or a web app. huge number of app developers are inclining towards hybrid applications as it is viable.

Although there is no substitute for the native apps, there are many alternative means to develop a cross-platform cost-effective applications and are being supported by both the platforms. A high degree of latency while dealing with the hybrid apps is seen on both the platforms along with other inconsistencies such as access to GPS, Notifications panel, camera and other resources which fail to work often on android and also on IOS to some extent, in spite of the code being unchanged. Android users often get demented to use the back button of the system or the button that is provided on

the app screen, when using apps such as e-commerce, services etc. web apps, as the behavior of both the buttons is same.

D. Advertisement (Android vs. IOS)

Advertising in mobile apps has become predominant for the private sector and has created a huge economic value to the businesses. Running a proper mobile advertisement campaign has led to dramatic increase in the conversion rate for businesses. When we speak about mobile advertisement Google's Ad mob and Apple's iAd services cover almost every mobile device on the planet. The ability of the businesses to track important metrics while running an advertisement campaign on these services has gained trust of many businesses across the world. In spite of providing data and control on various metrics for the advertisers and publishers, we believe that there is a certain degree of uncertainty in placing the advertisement in relevant mobile apps. Generating stats of CTR, CPC etc. may not be a proper indicators for the advertisers to make their business decisions as there can be an enough number of accidental clicks, placement of Ads at irrelevant places which might be again due to the accidental clicks or might be due to the placement of the advertisement at places where the user have to click (ex: placement of Ad space near to the button by the publisher where there is a high possibility of unintentional clicks.). This might deliver false stats to the advertisers. This leads to wastage of money as the CPC will be withheld from the advertiser for the unintentional clicks.

Google Ad mob has a greater fill rate and allows publishers to post full screen Ads more frequently than the iAd, which helps the advertisers in creating more impressions but also frizzles the app users and eventually make them uninstall the app. This scenario is turning into a major factor for the android users to switch from android to other platforms. On the other hand, iAd maintains a balance between fill rate of the Ads and user experience on the device. But iAd lacks in delivering the important insights to advertisers about their Ad campaign. Lack of metrics such as places where the Ads are being posted etc. are where the Ad mob is gaining an edge.

E. Cost (Android vs. IOS)

Cost is another major criteria that every individual, and also the businesses look into while choosing to buy a product or to run a business for start-ups, and medium scale organizations. It is interlinked with many other factors that are essential for the businesses.

Android

Android is available in diverse set of form factors such as smartphones, tablets, wearable, automobiles etc. there are plenty of developers working to build apps and also on Operating System for the above mentioned. Approximately 2.3 million app developers across the world, 70% (not

exclusively android developers.) Of the app developers target android. I.e. approximately 1.61 million app developers for android. Every android developer needs to pay an amount of 25\$ to google for signing up as an android developer to make their developed applications available to the android users through the Play Store. Which sums up to approximately 40.25 million dollars that google made from the new developer registrations.

The android developers have a choice to sell their app or making it freely available or make it freemium (i.e. in-app purchases). In spite of google receiving 30% of transaction fees as operating charges from paid apps, freemium apps. Approximately 20% of apps on play store are paid apps and freemium apps i.e. 3,35,381 apps (including apps that globally available and apps targeted to certain regions.) are paid apps. Assuming that each paid app developer with an average of 10K downloads, generates a revenue of 2000\$ from the app, 600\$ from each developer goes to google. Google makes 20,12,28,600\$ from the operating charges. And the same applies for the freely available apps on play store which advertise on mobile and as there are about 80% of apps which adopted this model for monetization. i.e. 13,41,524 apps (including apps that globally available and apps targeted to certain regions.) are available for free to the users and generate revenue through Google's Ad mob. Providing necessary tools to develop an app and necessary backend cloud support for free. Therefore with a very little investment, an android developer have a healthy scope for generating good ROI.

IOS

IOS is available in iPhone, iPad, iPod. Approximately 30% (not exclusively IOS developers.) developers target IOS to develop applications. Every IOS developer need to pay 99\$ to sign up as an IOS app developer and upload any number of apps on to the app store within that span of an year. i.e. approximately 68 million dollars that apple made from the new developer registrations.

There are around 33% of paid apps on the app store i.e. approximately 5 lakh paid apps on the app store. As apple keeps 30% of each app sales. It makes around 16,66,667\$ from the paid apps. The IOS developer's revenue depends mostly factors such as number of downloads, user activity etc. which helps when the app has healthy metrics to generate effective ROI.

F. Availability of application (Android vs. IOS)

Being a widespread mobile platforms in the world, Android and IOS are served by app stores with numerous apps serving different purposes. Google play holds the apps that can be used on android and Apple app store does the same as play store for IOS. In the mass consumer market of the present day, the rate and direction of innovation in apps in both the platforms is depending much on the response of both the technical and non-technical people, leading to the increase of the demand for apps for various purposes. The entrepreneurs and app developer teams are getting benefitted

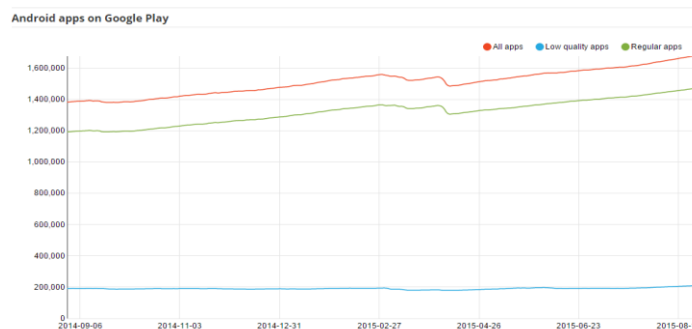
through making good revenue by dropping apps in app stores to fulfil the requirement of app demanders. But the matching of apps in the app stores to right customers seems to be uncertain. Developer teams invest a lot on targeting keywords to index their app on top listings on app store and on product marketing as well.

The platforms which reduced the development costs to increase the productivity, are also the platforms on which more investment is needed to make the product noticeable on app stores. The current app ranking methodology used to match the apps to the consumers that aggravate the app downloads or revenue seems to be inaccurate. We believe that these ranking mechanisms fail to reflect appropriate apps and match to the consumers. This is leading to the raise of 3rd party firms which filter for quality apps from the huge number of apps in the app store.

Google Play

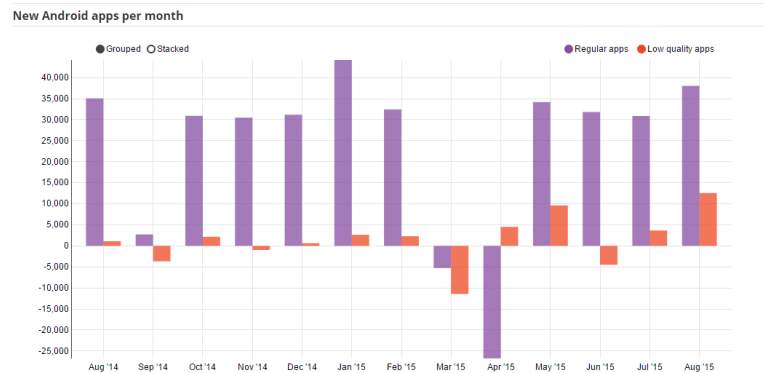
Google being a supplier of android market, have also hosted an online store known as google play. Since the inception of android app market, google have been receiving huge number off app submissions across the world to make different services, productive tools, games, eBooks etc. available to the android users, unlike any other successful online app stores, google lets the android app developers to distribute their android app from the platform of their choice. Such as AWS, or from their own Web Services, or elsewhere. Google does not hustle up the services with android platform.

As per the Aug.2015 stats, the google play holds 1,676,905 apps and growing. The whole number of apps on google play include the Regular apps, newly arrived, low quality. Google cleans up the store roughly once in a quarter of a year by removing the useless and very less accessed content. The below are the approximation of number of apps that are regularly accessed by the users, low quality apps, and all the apps from Aug.2014 to Aug.2015.



Source: <http://www.appbrain.com/stats/number-of-android-apps>

As we earlier said that google receives enormous app submissions. In which there might be apps that are useful & unwanted apps to the users in the new arrivals. We categorized the unwanted apps as low quality apps on the app store. The below is a snapshot of new arrivals of each month from Aug.2014 to Aug.2015.

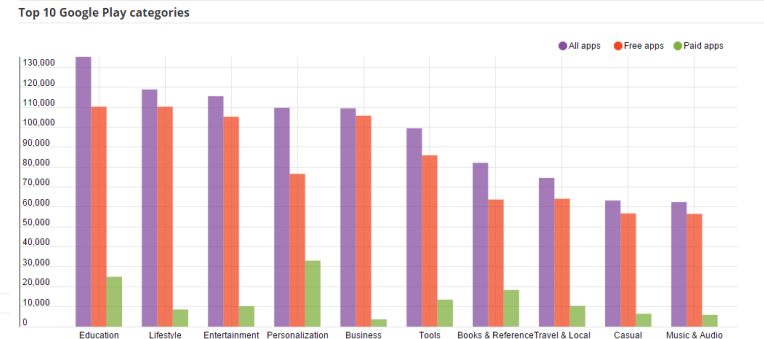


Source: <http://www.appbrain.com/stats/number-of-android-apps>

Regular apps: apps that are downloaded by more number of users.

Low quality apps: apps with less downloads, higher bounce rate etc.

Google play has a diverse set of categories with complex set of top lists such as Top Paid, Top Free, Top Grossing, New Apps etc. both overall and within categories. The criteria considered to rank the apps in each category or among categories are important differences is the number of downloads that an app has, over a period of eight days. Otherwise the listing is done based on the user's actions or opinions on apps on play store. The below are the approximate number of apps that are available in top ten categories till Aug.2015.



Source: <http://www.appbrain.com/stats/android-market-app-categories>

Discrepancies in Play Store

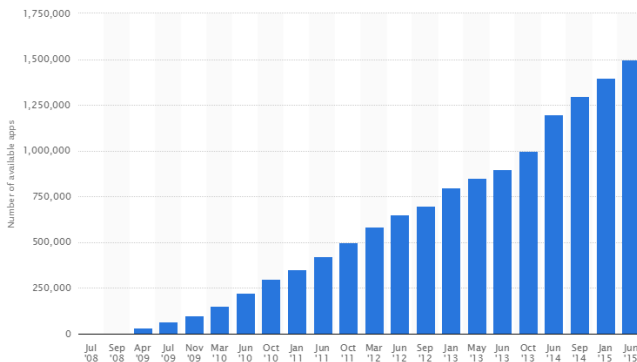
App developers who newly entered into the android market with an android app, show considerable annoyance as they do not have a pre-existing relation with the android app consumers. Thus, developer gets frizzled as the app store's matching mechanism doesn't seem promising.

There is a possibility of using backdoor methods (such as Keyword stuffing, illegal backlinks etc.) to make a particular app list on top, leaving the quality apps list somewhere else in the list of apps. This leads to the increase in bounce rate. The five star rating that's given by an individual app user may not reflect the actual quality of a particular app.

Play Store doesn't guarantee the android users of the apps that are being downloaded from the play store are secure and doesn't harm the device or data. As it seem to have no filtering process before making an app available to the users to download it. Anyone can pay 25\$ and upload an app on to the play store.

iTunes

Unlike google play is an app market for android, iTunes is an app market for Apple devices. Apple packages all its services to make it feasible to access its services on any apple device. The application store was added to iTunes with 500 apps in July, 2008 and rose to approximately 1.5 million apps of various categories to its users, including health and fitness, music and reference apps. The figure includes 725,000 apps built only for iPad as well. All the apple devices have only one means to install apps i.e. iTunes. The below are the stats of overall growth in the number of apps in the app store since its inception.



Source:<http://www.statista.com/statistics/263795/number-of-available-apps-in-the-apple-app-store/>

iTunes displays the most downloaded apps in last 24 hours on Top Charts list. The iOS app developers need to convince Apple to publish their app on app store, which ensures very less possibility of malicious content entering app store.

Both the app stores play a major role while a consumer chooses between the platforms. Both the app stores contain a huge collection of free apps, paid apps, freemium apps and also commonly available apps on both platforms. It is predicted that app downloads on both the platforms will reach 90% of global app downloads by 2017. Apple has announced that, there've been 100 billion app downloads from July 2008 to June 2015. And the google play had over a 50 billion app downloads. That means, both the app stores combined together processed a data of approximately over 150 billion app downloads. i.e. approximately 1500 Petabytes of data. Considering each app to be of 10MB of size on both platforms. This indicates a noticeable investment of the both firms on the maintenance of the resources to support the app stores. On a broad view,

app stores also play a major role in generating an enormous flow of data over the internet apart from the social media, search engines, P2P downloads ("Torrent") etc.

Entrepreneurs who extend their services to the users of both android and iOS need to invest on making the app noticeable in play store and app store individually. Therefore the investment on the mobile app is almost double.

IV. CONCLUSION

In this paper, we've thrown some light on few inconsistencies in both the Android and IOS mobile platforms, where many firms, individual developers, developer teams etc. fall in conundrums. The major platforms has begun seem like a quagmire. On top of these inconsistencies, the security aspect in both the platforms has become another issue. People from some parts of Asia, Europe, and other parts of the world have started being reluctant to the Android devices and the fresh dispute between the Apple Inc. and FBI in US is leading to the break of trust of many firms and individuals on these platforms.

On the other hand, these Operating Systems have made a huge impact in the way the firms, individuals work every day. The dramatically reduced cost of mobile devices (Android in particular), made people in India, and many other countries in the world to show interest in mobile technology, which indirectly boosted the innovation in mobile sector.

ACKNOWLEDGMENT

I have taken efforts in this paper. However, it would not have been possible without the kind support and help of Smt. Annapurna. I would like to extend my sincere thanks to her.

I am highly indebted to Smt. Annapurna and Dr. Y. Satyanarayana Murty for their guidance and constant supervision as well as for providing necessary information regarding the research & also for their support in completing the paper.

I would like to express my gratitude towards my parents & members of National Informatics Center for their kind co-operation and encouragement which help me in completion of this paper.

I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

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